and steelhead populations in the Central Valley by 2002 through changes in flows and project facilities and operations.

SALMON, STEELHEAD TROUT AND ANADROMOUS FISHERIES PROGRAM ACT

DFG is required under the Salmon, Steelhead Trout and Anadromous Fisheries Program Act of 1988 to restore salmon and steelhead runs in the Central Valley.

THE DELTA NATIVE FISHES RECOVERY PLAN

This plan prescribes efforts to assist the recovery of many fish species native to the Central Valley, including delta smelt, splittail, and other native fish species.

ENDANGERED SPECIES ACT

The National Marine Fisheries Service (NMFS) is reviewing the status of steelhead trout in the Central Valley. Any restoration program developed under the federal Endangered Species Act (ESA) will be compatible with recommendations in the ERPP.

The health of the Ecological Management Units of the Yolo Basin Ecological Management Zone can be maintained and restored only with the active participation of local watershed groups, which include local landowners and concerned individuals.

NATIVE SPECIES RECOVERY PLAN FOR LOWER PUTAH CREEK

A recovery plan for Lower Putah Creek native fish species was prepared in 1996. This plan is intended to re-establish and maintain: (10 a resident native cool water fish assemblage, (2) a mixed native warm-water fish assemblage, (3) a warm-water game fish assemblage, and (4) a native anadromous fish assemblage. Many of the ERPP targets and programmatic actions for Putah Creek are consistent with the recommendation in this plan

WATERSHED ORGANIZATIONS

Some watershed groups that already have been established in the Ecological Management Zone are:

- Cache Creek Conservancy,
- Cache Creek Stakeholders Group,
- UC Davis Putah-Cache Bioregional Project,
- Solano County Water Agency,
- Water Resources Association of Yolo County,
- Farm Bureau
- Putah Creek Landowners Association,
- Putah Creek Council,
- Yolo County Resource Conservation District,
- Yolo Basin Foundation,
- Flood Plain Management Group,
- Blue Ridge Ranchers, and
- Quail Ridge Conservancy.

Efforts in the Yolo Basin will be linked to similar work by the California Waterfowl Association, Ducks Unlimited, The Nature Conservancy (TNC), and the California Rice Industry. The overall success of these efforts will require cooperation from resource agencies, such as the California Department of Fish and Game (DFG), California Department of Water Resources (DWR), and USFWS, as well as participation and support from the U.S. Bureau of Reclamation (Reclamation), Natural Resources Conservation Service (NRCS), private organizations, water districts, county and city governments, and individual landowners. These groups will work together to maintain and restore streamflows and fish and wildlife habitat, develop additional water supplies to reduce impacts of diversions, and minimize poaching and degradation of habitat and water quality in basin streams. To support this effort, funding may be provided to enhance streamflows, reduce problems related to fish passage, install screens at diversions, restore habitats, and increase enforcement of the California Fish and Game Code to protect recovering populations of salmon and steelhead.

WILLOW SLOUGH INTEGRATED RESOURCE MANAGEMENT PLAN

To implement a set of resource management practices, the Yolo County Resource Conservation District (RCD) is working with local landowners, and local, state, and federal agencies under the Willow Slough Integrated Resource Management Plan. The goal of this plan is to enhance the natural resources of the watershed using voluntary, small-scale, on-farm, and reproducible management practices. The resources and problems that could be jointly managed include stormwater runoff, erosion,

sedimentation, chemical use, wildlife habitat, and groundwater recharge.

A resource inventory completed during the plan development process found multiple benefits could be achieved. The analysis focused on opportunities for creating or enhancing wetland and riparian habitats, augmenting groundwater recharge, and decreasing flooding problems.

Linkage to Other Ecological Management Zones

Many of the resource elements in the Yolo Basin Ecological Management Zone depend on conditions or elements in other zones, including the Sacramento River and Delta. The Yolo Basin Ecological Management Zone has important connection with the North Delta Ecological Management Zone. The major area that connects the two is the Yolo Bypass. The upper section of the bypass (above the Interstate 80 causeway) is in the Yolo Basin Ecological Management Zone and the section below the causeway is in the North Delta Ecological Management Unit.

The connections between these areas also include other ecosystem elements. Anadromous fish, for example, are highly migratory and depend on conditions in the mainstem Sacramento River, the Delta, the San Francisco Bay, and the nearshore Pacific Ocean. Because these fish are affected by stressors throughout their range, such as unscreened diversions, water quality deterioration, and harvest, restoring salmon and steelhead populations in the Yolo Bypass will require efforts in other zones.

Restoration Targets and Programmatic Actions

Ecological Processes

Central Valley Streamflow

Target 1: More closely emulate natural seasonal patterns in Cache and Putah Creeks by providing additional flows, when available from existing water supplies. Flows in the Yolo Bypass would be supplemented, as needed, by the Colusa basin drain through the Knights Landing Ridge Cut Canal, extending the Tehama-Colusa Canal, and the Sacramento River through the Fremont weir. Supplemental flows may be needed in fall if water temperature and flow in the lower Yolo Bypass are insufficient for passage from Cache Slough to upstream areas in the Sacramento River. Supplemental flows may be needed in winter and spring to sustain downstream migrating juvenile salmon and steelhead on their journey through the Yolo Bypass to the Delta. Supplemental flows would be needed along with irrigation water from spring to fall to sustain native fish, wetlands, and riparian habitats in channel sloughs of the Yolo Bypass (◆◆).

Programmatic Action 1A: Develop a cooperative program to provide water for summer flows in Cache Creek to maintain riparian vegetation by developing new conjunctive supplies, including groundwater.

Programmatic Action 1B: Develop a cooperative program to provide water for the target flows in Putah Creek from additional Lake Berryessa releases or reductions in water diversions at Solano Diversion Dam and in the creek downstream of the dam. Water would be obtained from willing sellers, water transfers, and by developing new supplies, including groundwater.

Programmatic Action 1C: Cooperatively evaluate the feasibility of providing water for the upper Yolo Bypass portion of the Cache Creek Unit by redirecting water from Colusa basin drain through the Knights Landing Ridge Cut Canal, an extension of the Tehama-Colusa Canal, and the Sacramento River through the Grays Bend-Old River-Fremont weir complex.

Rationale: *Supplemental summer flows proposed in Cache Creek would sustain newly established riparian vegetation and provide refuge for native resident fish. Flows from the Colusa basin drain, Tehama Colusa Canal extension, and the Sacramento River are necessary to provide sufficient flow in the Yolo Bypass during the spring through fall irrigation season to sustain native fish, wetlands, and riparian habitat; additional supplemental flow may be needed during the late-fall through early spring salmon and steelhead migration season. These flows will sustain native resident fish species and salmon and steelhead using the Yolo Bypass route to and from the upper Sacramento River watersheds.*

Flow in this area would pass south along both sides of the Yolo Bypass, merging with any supplemental Cache and Putah Creek flows along the west side of the Yolo Bypass. A weir or screen will be placed at the Knights Landing Ridge Cut Canal outlet to keep salmon and steelhead from migrating upstream into the Colusa basin drain. Fish passage facilities will be constructed at the Grays Bend-Old River-Fremont weir complex to allow migrating adult salmon and steelhead moving upstream through the Yolo Bypass toward upper Sacramento River basins to enter the Sacramento River. Downstream migrating juvenile salmon and steelhead will not be discouraged from moving from the Sacramento River into the Yolo Bypass, because conditions should be optimal for rearing and migrating on their way to the Delta.

Improved streamflows are one of the most critical ecosystem elements required to promote healthy native fish populations in Putah Creek. Opportunities to provide the needed flows are presently limited, but that does not lessen the need to continue efforts to find a collaborative means by which to meet the needs for all the beneficial uses of Putah Creek water. There are four general classes of streamflow needs for Putah Creek native fishes: (1) flows for native fish rearing, (2) flows for native fish spawning, (3) flushing flows to push non-native pond fish downstream, and (4) anadromous fish flows. The first two streamflow needs are of higher priority at this time and alternatives to using streamflows to control non-native fish species need to be further examined. Restoring more natural channel characteristics, providing instream habitats such as woody debris, pools, overhanging vegetation, may provide native species with the advantage required to displace naturally or successfully compete non-native species such as the red shiner.

COARSE SEDIMENT SUPPLY

TARGET 1: Restore gravel recruitment in Cache and Putah Creeks to meet the needs of spawning fish, maintain natural stream channel meanders and bar formation where consistent with flood protection and adjoining land uses, and match existing rates of downstream displacement (◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to supplement gravel recruitment below Solano Diversion Dam as needed to replace natural gravel recruitment interrupted by the diversion dam.

PROGRAMMATIC ACTION 1B: Develop a cooperative program to supplement gravel in areas downstream of the diversion dams where other structures or gravel mining has interrupted the gravel recruitment process.

RATIONALE: *Gravel recruitment has been severely interrupted in Putah Creek from dam construction. Replacement is necessary below the dam to sustain fish rearing habitat, feasible stream meander, and riparian corridors. Consistent with this is the need to improve the stream channel characteristic of Putah Creek downstream of Solano Diversion Dam. Of concern is the existing channel geometry including width and depth.*

NATURAL FLOODPLAIN AND FLOOD PROCESSES

TARGET 1: More closely emulate natural stream channel configurations in Cache Creek and Putah Creek, as well as in channels and sloughs of the upper Yolo Bypass, consistent with flood control requirements (◆◆).

PROGRAMMATIC ACTION 1A: Cooperatively evaluate the feasibility of modifying the cross sections and channel configurations in Cache and Putah Creeks to provide a more natural configuration, while maintaining consistency with flood control requirements and minimizing impacts to adjoining established land uses.

TARGET 2: Increase overbank flooding potential to floodplains, where feasible and consistent with flood protection, to support a desirable vegetation succession process (◆).

PROGRAMMATIC ACTION 2A: Evaluate opportunities to provide flow to Yolo Bypass from Colusa basin drain, extending the Tehama-Colusa Canal, and Sacramento River (through Fremont weir) in dry and normal water years, as well as normally occurring overflow in wetter years.

TARGET 3: Increase the area of flooding to the active Cache and Putah Creek floodplains during the wet season, where feasible and consistent with flood protection (◆◆).

PROGRAMMATIC ACTION 3A: Evaluate the feasibility of expanding floodplain overflow areas in the lower Cache and Putah Creek floodplains. Such areas would include sloughs and creek channels, setback levees, and wetlands, where feasible and consistent with flood protection.

TARGET 4: Establish a desirable level of floodwater retention potential by expanding, where feasible and consistent with flood protection, the floodplain area of the Yolo Bypass, lower Cache Creek, and lower Putah Creek, and by developing off-channel water storage facilities (◆◆).

PROGRAMMATIC ACTION 4A: Cooperatively evaluate the feasibility of reoperating and modifying the Yolo Basin to increase its capacity for floodwater detention and sediment retention by reconfiguring levees, channels, and other physical constraints to large-volume flow events.

RATIONALE: *Overbank flooding is a regular occurrence in the Yolo Bypass in flood years. Proposed actions will provide this valuable process in dry and normal water years when no flooding of the Bypass would normally occur. Flooding in the Bypass sustains wetlands and provides for the transfer of considerable amounts of nutrients and organic materials to the Delta and Bay, where it serves the valuable purpose of contributing to the estuarine foodweb. Developing floodplain overflow areas and off-channel water storage facilities along lower Cache and Putah Creeks will help reduce flood damage, provide supplemental flows during the summer, and improve fish, riparian, and wetland habitats, and further contribute nutrients and organic materials to the Bay-Delta foodweb.*

Natural floodplain overflow basins and off-channel water storage facilities serve to store sediment, nutrients, and water, making them available for other uses and to the rivers at other times. The subsurface water and sediment flow and nutrient retention also help form and maintain riparian habitats, which provide spawning and rearing habitat for native resident fish during higher water periods.

Successful restoration of the Yolo Basin streams will minimally require considerable stream channel reconfiguration. The intent is to restore channels to configurations that can be retained in a natural state by the proposed flows, natural erosion and sedimentation processes, riparian vegetation succession, and gravel-sediment regimes (patterns), where feasible with flood protection and adjoining land uses.

Increasing the flood capacity of the bypass may be necessary to develop and implement future riparian habitat restoration programs. Riparian vegetation reduces flood capacity, so an effective riparian restoration program in the Yolo Basin would need to be integrated with a program to offset any potential loss by increasing capacity.

HABITATS

RIPARIAN AND RIVERINE AQUATIC HABITAT

TARGET 1: Restore riparian vegetation along Cache Creek, Putah Creek, and Yolo Bypass and Solano Ecological Management Unit channels and sloughs, where possible, to provide cover and other essential habitat requirements for native resident fish species and wildlife (◆◆◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to restore riparian vegetation, where possible and fill gaps in forest continuity.

PROGRAMMATIC ACTION 1B: Develop a cooperative program to protect existing riparian corridors along creeks, streams, sloughs, and channels connecting to the Delta.

PROGRAMMATIC ACTION 1C: Develop a cooperative program to plant riparian vegetation and provide for early development until it becomes naturally self-sustaining.

PROGRAMMATIC ACTION 1D: Develop a cooperative control program for non-native riparian plants, where necessary, to promote development of healthy natural riparian corridors.

RATIONALE: *Healthy riparian corridors along creeks, sloughs, and channels, including those in the Yolo Bypass, provide essential cover, shade, and food for spawning, rearing, and migrating native resident fishes and other wildlife.*

FRESHWATER FISH HABITAT AND ESSENTIAL FISH HABITAT

TARGET 1: Maintain and improve existing freshwater fish habitat and essential fish habitat through the integration of actions described for ecological processes, habitats, and stressor reduction or elimination (◆◆).

PROGRAMMATIC ACTIONS: No additional programmatic actions are recommended.

RATIONALE: *Freshwater fish habitat and essential fish habitat are evaluated in terms of their quality and quantity. Actions described for American River Basin Ecological Management Zone ecological processes, stressor reduction, and riparian and riverine aquatic habitat should suffice to maintain and restore freshwater fish habitats. For example, maintaining freshwater and essential fish habitats is governed by actions to maintain streamflow, improve coarse sediment supplies, maintain stream meander, maintain or restore connectivity of streams in this zone and their floodplains, and in maintaining and restoring riparian and riverine aquatic habitats.*

REDUCING OR ELIMINATING STRESSORS

WATER DIVERSIONS

TARGET 1: Screen all diversions in the Yolo Bypass channels and sloughs (◆◆◆).

PROGRAMMATIC ACTION 1A: Evaluate the feasibility of screening diversions in the Yolo Bypass with positive-barrier fish screens.

RATIONALE: *Reducing loss of juvenile salmon, steelhead, native resident fishes, nutrients, organic debris, and aquatic invertebrates is essential to restoring salmon, steelhead and native resident fish populations to the Yolo Bypass. Unscreened diversions are a significant threat to downstream migrating juvenile salmon and steelhead in late winter and early spring, and to oversummer rearing steelhead in upstream rearing areas. Salmon and steelhead populations from the upper Sacramento River watersheds will benefit from reduced stranding losses in the Yolo Bypass.*

DAMS AND OTHER STRUCTURES

TARGET 1: Improve fish passage between the Delta and spawning grounds in the upper watersheds (◆◆).

PROGRAMMATIC ACTION 1A: Evaluate the feasibility of constructing fish passage facilities at the Grays Bend-Old River-Fremont weir complex at the upper end of the Yolo Bypass.

PROGRAMMATIC ACTION 1B: Evaluate the feasibility of providing fish passage at the Solano Diversion Dam.

RATIONALE: *During floods, large numbers of adult late-fall-, winter-, and spring-run chinook salmon, as well as winter- and spring-run steelhead from the upper Sacramento River watersheds, migrate upstream through the Yolo Bypass. As floodwaters recede, some of these fish are delayed or stranded behind the Fremont weir. Additional releases from the Colusa basin drain and Fremont weir will further aggravate this existing problem. Ensuring fish passage into upper Sacramento River watersheds from the Yolo Bypass is essential to restoring these wild salmon and steelhead runs to the Sacramento River basin.*

Providing fish passage at Solano Diversion Dam would allow salmon and steelhead passage into the cold tailwaters of Monticello Dam. The interdam reach - several miles of high quality riparian and shaded riverine aquatic habitat - currently supports wild trout and stocked trout fisheries. With appropriate spawning gravels, the 12-mile reach between Solano Diversion Dam and Monticello Dam could provide good spawning and rearing habitat for salmon and steelhead. This reach offers excellent habitat for oversummer rearing of juvenile steelhead.

GRAVEL MINING

TARGET 1: Protect, enhance, and restore natural gravel recruitment within the active floodplain and remnant gravel pits (◆◆◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to incorporate remnant gravel pits into active creek floodplains to increase the channel area and restore natural channel configurations, while providing for the maintenance

of flood capacity and protection of adjoining land uses.

RATIONALE: *There are remnant gravel mining effects in lower Cache and Putah Creeks. Restoring the natural channels by integrating remnant pits with the active floodplain will ensure that juvenile native resident fish are not stranded in ponds and exposed to the unnatural levels of predatory fish that reside in these ponds. Increasing the width and variation of the channel in those areas altered by former gravel mining operations will restore gravel recruitment to the river and allow for the development of more natural and stable stream channels and riparian habitat.*

Invasive Riparian and Marsh Plant Species

TARGET 1: Reduce populations of invasive non-native plant species that compete with the establishment and succession of native riparian vegetation along Cache Creek and Putah Creek. This will help to reestablish native riparian vegetation in floodplains, increase SRA cover for fish, and increase habitat values for riparian-associated wildlife (◆◆◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to monitor the distribution and abundance of non-native plants and develop cooperative control programs as needed.

RATIONALE: *Non-native plant species, such as false bamboo, salt cedar, eucalyptus, water hyacinth, and pepperweed, can undermine riparian habitat value to fish and wildlife, as well as the natural plant succession that contributes to the physical character of the riparian corridors.*

Predation and Competition

TARGET 1: Reduce predation and competition on native fish species (◆◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to modify the stream channel and improve aquatic habitats. *(Refer to recommendations for streamflow, sediment supply, floodplain, and contaminants.)*

RATIONALE: *Habitat alteration often provides a competitive advantage to non-native fish species and native fish species decline as a result of poor habitat, predation, and competition for limited nutrients and habitat. Reducing the adverse effects of non-native species can be achieved by a program to restore ecological processes, habitats, and reducing other stressors to the extent possible.*

Contaminants

TARGET 1: Restore and maintain water quality in the Cache Creek watershed (◆◆).

PROGRAMMATIC ACTION 1A: Identify the sources and reduce the amounts of mercury and other contaminants coming into the watershed from upstream sources.

TARGET 2: Restore and maintain water quality in the Putah Creek Watershed (◆◆).

PROGRAMMATIC ACTION 2A: Develop and implement a Streamkeeper program on Putah Creek.

RATIONALE: *Implementing a "Streamkeeper Program" on Putah Creek would provide an effective means by which to monitor a variety of environmental factors that influence the watershed health below Monticello Dam. In addition to collecting water samples for chemical analysis a streamkeeper could (1) monitor telemetered stream gauges, (2) conduct frequent site visits, (3) identify and plan restoration projects, (4) provide local public outreach with private landowners, (5) monitor the native resident fishery, (6) act as a watchdog for the creek, and (7) provide useful information local government, and state and federal agencies regarding the health of Putah Creek.*

Stranding

TARGET 1: Prevent adult salmon and steelhead stranding in the Yolo Bypass during their upstream migrations (◆◆).

PROGRAMMATIC ACTION 1A: Evaluate the feasibility of constructing fish passage facilities at the Grays Bend-Old River-Fremont weir complex at the upper end of the Yolo Bypass.

PROGRAMMATIC ACTION 1B: Develop a cooperative program to construct a weir or screen at the lower end of the Knights Landing Ridge Cut Canal to keep adult salmon and steelhead from migrating upstream into the Colusa basin drain.

RATIONALE: *The stranding and subsequent losses of juvenile and adult fish in the Yolo Basin Ecological*

Management Zone have been observed in past years. Additional information is required to identify effective measures to reduce or eliminate these losses. Potential measures need to be consistent with the overall goal of restoring processes, habitats and species while maintaining or improving flood control capacity of the system.

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◆ EASTSIDE DELTA TRIBUTARIES ECOLOGICAL MANAGEMENT ZONE

Gravel Replenishment on the Mokelumne River.

INTRODUCTION

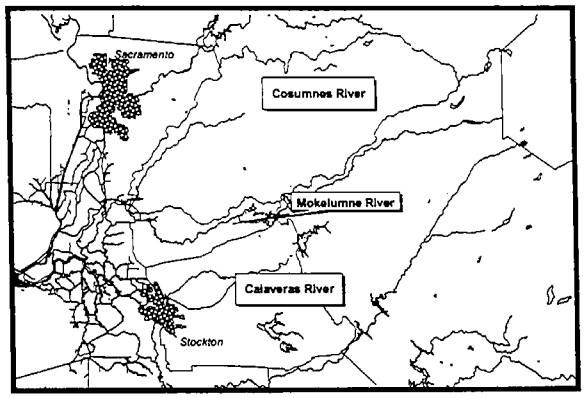
The health of the Delta is closely linked to the health of its component watersheds. The major watersheds contributing streamflow to the Delta include the Sacramento River, San Joaquin River, and the eastside Delta tributary streams. Cumulatively, these provide over 95% of the annual freshwater inflow to the Delta and provide migration, spawning, and rearing habitat for resident, anadromous, and some estuarine fish that depend on a healthy Delta ecosystem. The eastside Delta tributary streams can support increased abundances of resident, anadromous, and estuarine fish, such as steelhead, chinook salmon, and splittail, which will, in turn, contribute to the overall Delta health.

DESCRIPTION OF THE MANAGEMENT ZONE

The Eastside Delta Tributaries Ecological Management Zone includes the three major tributaries entering the Sacramento-San Joaquin Delta on its east side:

- Cosumnes River Ecological Unit,
- Mokelumne River Ecological Unit, and
- Calaveras River Ecological Unit.

Important ecological processes within the Eastside Delta Tributaries Ecological Management Zone include streamflow, stream meander, gravel recruitment and cleansing, sediment transport, flood and floodplain processes, and water temperature. Important habitats include seasonal wetlands and riparian and shaded riverine aquatic (SRA) habitat.



Location Map of the Eastside Tributaries Ecological Management Zone and Units.

Fish and wildlife resources in the basin include fall-run chinook salmon, steelhead, splittail, other native resident fish, and waterfowl. Fall-run chinook salmon and steelhead populations are generally unhealthy due to poor habitat conditions. Achieving healthy status for these salmonid populations, as well as for splittail, will depend on actions implemented in this zone and on complementary restoration actions in the Sacramento-San Joaquin Delta Ecological Management Zone. The confluences of the Mokelumne, Cosumnes, and Calaveras rivers, as they enter the Delta, are important backwater floodplain areas that support excellent riparian habitats. These areas provide important habitat for juvenile chinook salmon, delta smelt, splittail, giant garter snake, and sandhill crane.

Notable stressors to ecological functions, processes, habitats, and resources within the zone include:

- altered instream flows,
- altered water temperature regimes,
- separation of rivers from their floodplains,
- interruption of gravel recruitment and cleansing processes,
- reduced sediment transport,
- poor land use and livestock grazing practices,
- high levels of predation on juvenile salmonids,

- entrainment of aquatic organisms in water diversions,
- restriction of fish passage at dams and diversion structures,
- input of contaminants,
- illegal salmon and steelhead harvest, and
- riparian vegetation removal.

List of Species to Benefit from Restoration Actions in the Eastside Delta Tributaries Ecological Management Zone

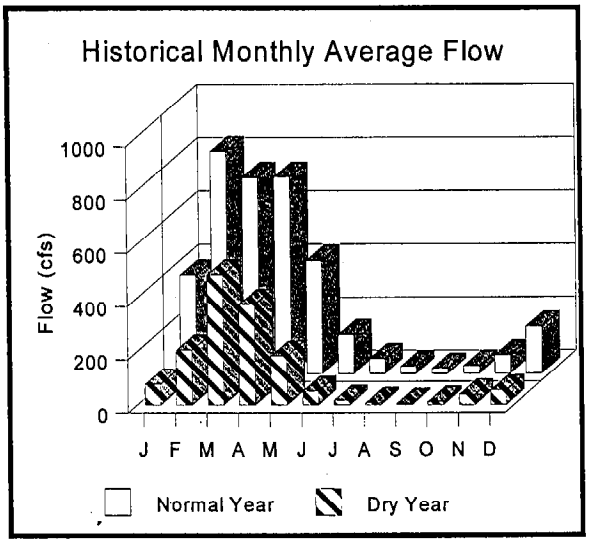
- splittail
- chinook salmon
- steelhead trout
- native resident fishes
- giant garter snake
- western pond turtle
- Swainson's hawk
- greater sandhill crane
- waterfowl
- plants and plant communities.

Descriptions of Ecological Management Units

Cosumnes River Ecological Management Unit

The Cosumnes River, with a watershed of approximately 1,265 square miles, drains the Sierra Nevada foothills and joins the Mokelumne River north of Thornton in the Delta. Flow records are available for Michigan Bar (535-square mile watershed), located near the base of the foothills as the river flows onto the valley floor. The Sly Park Dam (Jenkinson Lake) has a capacity of 40,000 acre-feet on the North Fork Cosumnes, with a watershed of 60 square miles. Releases are primarily into the Camino conduit for irrigation in Cosumnes and South Fork American River basins (average of about 25 cubic feet per second [cfs]). There are no other major impoundments in the Cosumnes River watershed, although several agricultural diversions are located between Michigan Bar and Thornton. Due to the low elevation of its headwaters, the river receives most of its water from rainfall rather than snowmelt. The entire Cosumnes River watershed is included in this Ecological Management Zone from its headwaters to the confluence with the Mokelumne River. The Cosumnes River floodplain lies primarily within the legally defined Delta boundary.

The Cosumnes River natural streamflow pattern is typical of Sierra foothill streams, with high late winter and early spring flows, moderate late spring flows, and very low summer and fall flows. Annual flows also vary greatly. Peak flows occur from February through April. In years with the highest rainfall, average monthly winter and early spring flows range from 4,000 to 6,000 cfs, but only from 80 to 120 cfs in August and September. In driest years, flows peak at only 30 to 50 cfs from February to May, while flows the remainder of the year are 0 to 20 cfs. Average monthly late winter and early spring flows in dry and normal years range from 400 to 800 cfs.

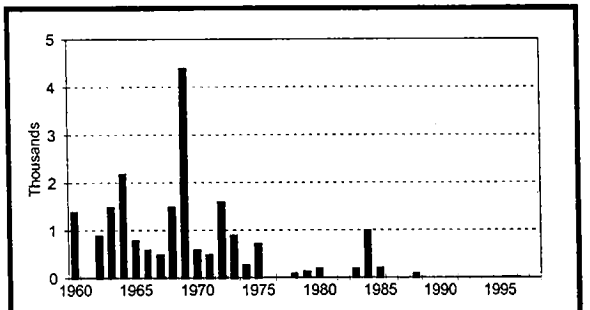


Cosumnes River Streamflow, 1962-1992 (Dry year is the 20th percentile year; normal year is the 50th percentile or median year.)

The historic flows at Michigan Bar are very similar to unimpaired flows, because there are limited diversions from the upper watershed, and Jenkinson Lake does not provide substantial regulation of winter and spring runoff.

During the 1950s, the Cosumnes River supported an average annual run of approximately 5,000 fall-run chinook salmon. During recent years, it has been estimated that the average annual run consists of a few hundred fish. The river has limited gravel areas

suitable for chinook salmon spawning but provides good rearing conditions for juvenile salmon. Spawning areas are located between Michigan Bar and Sloughhouse. Chinook salmon have been observed in the 40 miles of stream from the mouth to Michigan Bar. A natural migration barrier is located upstream from Michigan Bar.



Fall-run Chinook Salmon Returns to the Cosumnes River, 1960-1999 (CDFG 1999).

Low natural streamflow in summer and fall, particularly in low rainfall years, is the primary factor limiting the salmon run size in the Cosumnes River. In many years, the early portion of the run experiences difficulty negotiating the shallow bar and shoal areas, as well as high water temperatures. Only during normal and wet water years are winter and spring flows usually adequate for juvenile salmon emigration. Typically, 35 miles of the river between Twin Cities Road and Highway 16 are dry during the summer to early fall months.

Historically, the Cosumnes River overflowed its banks and deposited sediments, primarily sand, which formed natural levees. The area downstream of Wilton Road also had a mosaic of riparian (waterside) forest and freshwater emergent wetlands, whereas today, only remnant stands of valley oak woodlands remain.

Presently, the lower Cosumnes River between Dillard Road and Twin Cities Road is extensively leveed. Levees extend 15.8 miles along the right bank (facing downstream) and more than 3.6 miles along the left bank.

There are no water storage reservoirs on the mainstem Cosumnes River, and streamflows are altered primarily due to numerous small water diversions. There is one diversion dam (Granlees Diversion Dam) on the river, located approximately 1 mile upstream from the Highway 16 crossing. This dam has two fishways but their design is deficient by present standards. In addition, there are 157 registered appropriative water rights on the river. Most water is diverted out of the river from the first rains in the fall through early summer. This is the period when fall-run chinook salmon most need high flows.

Groundwater pumping is apparently the cause of a significant decline in the local groundwater table. This decline is responsible for the number of days of very little to no flow in the Cosumnes River, increasing from 82 days for water years 1942 through 1961 to 104 days for 1962 through 1982. Daily average flow data for the lower Cosumnes River have not been available since 1982, and the present number of very low to no flow days is probably greater. The decline in the groundwater table in the vicinity of the Cosumnes River and the increased days of very little to no flow limit access to the river by fall-run chinook salmon as they enter, or try to enter, the river in October and November.

Other factors limiting anadromous fish production in this ecological management zone include streambed incision and loss of spawning gravel due to the effects of levees, blocked upstream fish passage at small dams, entrainment of young salmon at water diversions, general climatic variations, oceanic conditions, and commercial and recreational fish harvest.

Opportunities to restore fall-run chinook salmon in the Cosumnes River are present. The major limiting factor is low or no flows in the lower river during the early upstream migration period (late September and October). In years when winter rains are late or lacking, salmon are not able to swim up the river and spawn.

The value of the Cosumnes River floodplain is becoming more apparent as recent studies have found splittail and juvenile chinook salmon utilizing that important habitat.

The lower Cosumnes River area also provides wintering habitat for greater sandhill cranes, roosting and foraging habitat for Swainson's hawk, and terrestrial and aquatic habitat for giant garter snake and western pond turtle.

Riparian habitat and channel conditions are affected by an extensive system of private levees along the